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BREAKING BOUNDARIES: INTEGRATING MILITARY AND TECHNOLOGICAL CULTURES TO ENABLE TRANSFORMATION

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ABSTRACT

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The idea of "transformation" began in 1999, but the process of building a military which embraces the concepts of "transformation", meaning a state of continuous change, requires that significant cultural adjustments be made in our military services. Further, the constant state of change requires the ability to identify and integrate technological advances much more quickly than we have in the past especially across the doctrine, organizational, training, material, leadership, personnel and facilities (DOTMLPF) performance pillars. Our warfighter and technologist professions are the key to achieving transformation as a process not, an end state. This paper explores the integration of these two communities as a critical point on the path to true transformational capacity for the U.S. military.

Both communities have proven to be rich in ideas, innovation and adaptability; however, there are cultural barriers to their ability to cooperate effectively. This SPR will demonstrate that there is common ground and a framework for integration of these cultures and offer systemic solutions aimed at overcoming clashes. Cultural integration has the potential to offer a smoother process of transformation for the Army and possibly DOD as a whole and reduce both the time and cost of bringing new capabilities to the field.

BREAKING BOUNDARIES: INTEGRATING MILITARY AND TECHNOLOGICAL CULTURES TO ENABLE TRANSFORMATION

> And let it be noted that there is no more delicate matter to take in hand, nor more dangerous to conduct, nor more doubtful of success, than to set up as the leader in the introduction of changes. For he who innovates will have for his enemies all those who are well off under the existing order of things, and only lukewarm supporters in those who might be better off under the new.
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> —Machiavelli[1]

The United States (US) Department of Defense (DOD) has undertaken the most challenging transformation efforts in US military history. As internet technology became widely used and effective in the 1990's military visionaries began to theorize about their military application. In essence, the question was how to use information to improve combat effectiveness? The implications of these theories were widespread and revolutionary. They required sweeping changes to the way the military thought about all its functions. Because transformation is designed to question the relevance and currency of the foundational components that guide our military forces it spreads across pillars such as: doctrine, organization, training, material, leadership, personnel, and facilities (DOTMLPF). Our military leaders have already moved down the road to transformation by planning for adaptation of cutting-edge technology and re-designing the force in to modular structures that satisfy current war-time and future operational needs. However, if transformation is to be truly successful we must seek out the gaps that exist between the top-down push for transformation and the grass roots commitment to its concepts. It would be naïve to assume that transformation will be successful no matter what the climate or culture.[2] It is basic human nature to resist change and to resent those imposing it if fundamental questions about the value of that change are left unanswered.[3] This paper addresses how transformation can be implemented effectively by understanding the cultures of those involved. Both technical and military professionals and their cultures possess the ability to facilitate transformation if they can work effectively together to create the vision of a versatile and adaptable joint force.

Our military has a deeply engrained culture, focused on providing the US with the best, most well-equipped force the world has ever seen. Field Manual (FM) 22-100 cites the importance of Army culture: "Soldiers draw strength from knowing they're a part of a tradition. Most meaningful traditions have their roots in the institution's culture."[4] By their very nature, cultures are steeped in tradition and norms that resist unexplained change or even change that is explained, but is not understood by the very warfighters who must deal with its results.

Warfighters generally accept new equipment and find new and interesting ways to fight with it. However, this adaptive process sometimes can take a great amount of time. One goal of the current transformation is to provide an atmosphere where change is readily accepted and adopted. This creates an environment where new systems that support our soldiers can be utilized as required to support the successful employment of our military instrument of national power. At this juncture, however, we find a clash between a desire for predictable continuity and near-term results valued by the warfighter and two issues of time – the pace of our newly emerging, fast-paced, and ever-changing world and the time it takes for the technical community to introduce and operationalize new technologies into the warfighter's arsenal. The collision of these seemingly competing concepts is where our leaders, over seven years ago, tried to catapult the U.S. military into their vision of the future and at the same time select, train and equip the current force to assure the nations super power status.

Further, a highly complex and unseen barrier resides within our technologist's cultures: their scientists and engineers. This is a broad and varied community, full of subcultures that are difficult to understand, manage, and lead. Not only do these specialized individuals work and create in a wide variety of technology areas - each with its own lexicon and culture, but they also have differing types of technical expertise, such as engineers (computer, electrical, mechanical, etc) who like to build working objects and apply them innovatively to solve perplexing problems. Scientists also cross a gamut of similar disciplines; they like to theorize about new possibilities and devise basic, non-applied innovations. Other specialized technologists, such as software developers and computer scientists who are unique to either of these camps, add further dimensions to the space of technological cultural. They have tremendous control over the implementation of new ideas in our new information-centric world. Much of the time these experts, despite their intellectual prowess, are underdeveloped in the interpersonal skills needed to bridge gaps among themselves and among peer cultures such as businessmen, lawyers, and military professionals.

In order to assure that DOD transformation is successful, the technical and military cultures that traditionally have remained separated must come together, sharing knowledge and understanding of each other to forge a complex relationship which spans differences in intellectual and core competencies. This integrated space will itself have many dimensions, so individuals from both sides will need an organizational climate that enables them to deliberate on the issues that are central to each other's mission areas. They must both be able to appreciate innovative and creative solutions which facilitate transformation. The concept of transformation is often misunderstood by both professional groups based on their perspectives.

Technologists see transformation as an opportunity to develop and use new technologies to support the warfighter. Often warfighters see transformation from an operational perspective. They seek to implement transformation through non-material solutions such as organization and doctrinal shifts, making the force more operationally flexible. Both concepts are credible forms of transformation, but this discussion requires a baseline for discussion.

Transformation

"Within the short span of a decade, the information age has exacerbated the continuous challenge of change."[5] This fact - coupled with the end of the Cold War, numerous limited wars and the troop strength draw down of the 1990s - left DOD with a challenge: Maintaining the world's most effective force. It is not widely acknowledged that many of the basic efforts supporting transformation began in the Clinton administration before Donald Rumsfeld became the Secretary of Defense. An effort to address transformational issues began in Fiscal Year (FY) 1999, long before the formal DOD Transformation Planning Guidance was published in 2003. At that time the Defense Advanced Research Projects Agency (DARPA) held the financial key to DOD's future. DARPA asked each service to provide its top three critical challenges for the purpose of investing in high-technology solutions to overcome specified challenges. Subsequently, a number of efforts were funded by DARPA in cooperation with the services. One example was the DARPA/Army Future Combat System (FCS) program. Since that time, the Army's FCS program has transitioned to the Army, and the Army along with its sister services evolved their transformational concepts.

Also critical to the transformational discussion are the concepts discussed in the Network Centric Warfare Books published by the Command and Control Research Program (CCRP). These books discuss concepts for providing a new strategy for warfighting by leveraging advanced information age capabilities. These concepts have met with both praise, from those who saw the need for new approaches emerging from Information Technology (IT) advances and criticism, primarily from warfighters who believed that this was an attempt to computerize all activities and thus to neglect the human components of Battle Command. IT proponents believe that if situation awareness (SA) data can be synthesized into information and absorbed effectively by warfighters into knowledge, then a tremendous advantage can be leveraged through the use of information technologies. But these IT concepts have been misinterpreted in many instances, obscuring their real value. Unfortunately, strategic leaders received too much incorrect information about how to leverage these theorized capabilities to fight and win our nations wars, which delayed promising adaptations of IT to support war-fighters.

In 2003, the broader and more illusive concepts of transformation were formalized and codified in the DOD Transformation Planning Guidance. This document defines transformation as "a process that shapes the changing nature of military competition and cooperation through new combinations of concepts, capabilities, people and organizations that exploit our nation's advantages and protect against our asymmetric vulnerabilities to sustain our strategic position, which helps underpin peace and stability in the world."[6] This definition is quite ambiguous and difficult to visualize; it offers no mental models.[7] Its use of the word "process" implies a more bureaucratic approach to transformation. In fact, military transformation must always be focused on one thing - the ability for our military to fight and win our nation's wars. As such, it must focus on warfighting capability as its primary goal. But it is surely not limited strictly to weapons or material solutions. Rather, transformation affects everything needed to support soldiers, airmen, sailors and marines as they venture to fight for our country. Of course, transformation is necessary in other areas such as business practices. But to confuse warfighter-focused transformational efforts with business practice transformation is irresponsible, especially in a time of war. A better definition might simply be "change". After all, the abstract noun "transform" is derived from the verb "to transform", meaning to change.[8] United States Joint Forces Command (USJFCOM) defines transformation simply as "the process of changing form, nature or function."[9]

In fact, the exploding advance of information technology, the expert application of technology by our current asymmetric enemy to adapt and to exploit our weaknesses forces us to rethink the concepts of transformation as it has evolved over the last few years. We must explore the framework across the DOTMLPF seeking improvements in technology that can be readily leveraged by our military enabling them to bring all assets to the fight with minimum effort. To do this we need flexible processes and a forward-looking culture of change. In fact, we need a better system, a system that continuously fosters innovation, creativity, and constructive failure. For without failure we do not learn. Moreover, this system must promote innovation, creativity and learning by leveraging the strengths of each pillar across the DOTMLPF simultaneously, not linearly.

Each service has implemented transformation in its own way. A Congressional Research Service (CRS) report for Congress (updated 17 February 2006) tells us that "The Army's transformation plan centers on organizing the army into modular, brigade sized forces called Units of Action (UA's) that can be deployed to distant operating areas more easily and can be more easily tailored to meet the needs of each contingency."[10] Additionally, many other efforts

such as the FCS acquisition program and new training initiatives are a part of the strategic plan to transform the Army.

The CRS report also observes that "The key elements of the Air Force's transformation plan include reorganizing the service to make it more expeditionary, and exploring new technologies and operational concepts to dramatically improve its ability to rapidly deploy and sustain forces, to dominate air and space and to rapidly identify and precisely attack targets on a global basis."[11] Curiously this does not seem new for the Air Force**.** In fact, much of the impetus for transformation came from the impressive new capabilities of the Air Force and their dramatic effects on the battlefield. Specifically, the ability to apply munitions from aircraft to targets on the ground with extreme precision through the use of technological advances.

Finally, the CRS report proclaims regarding the Navy that "Key elements of naval transformation include a focus on operating in littoral (i.e. near shore) waters, new-design ships requiring much smaller crews, directly launching and supporting expeditionary operations ashore from sea bases, more flexible naval formations and more flexible ship-deployment methods."[12] Indeed the Navy has drawn accolades from then - Secretary Donald H. Rumsfeld: "The Navy is a prime example of the benefits of these changes … The Navy is vastly more capable, more lethal and more agile today."[13] However, this seems to be more a success based on the realities of war and more efficient ways to fight them at sea than due to new IT transformation efforts.

Numerous challenges still exist for each service as they prepare for joint operations. The services have pursued vastly different transformational initiatives. Some may be further along than others, depending on which part of the DOTMLPF they focused on first. As DOD moves more and more toward joint operations, integrated solutions that include mission requirements, planning, identified gaps will be greatly beneficial. Effective long-term acceptance of transformational principles finally relies on cultural adaptability. To create cultural adaptability we must understand the cultures of the professionals required to produce transformation and how they need to evolve.

Culture

Culture is the critical component in effective and lasting transformation. It is also the most difficult to understand and change. Many years of focused study and effort have gone into understanding culture, organizational culture, and climate. Culture has been defined in multiple ways, but for the purposes of this discussion the following two definitions seem most applicable. Edgar H. Schein, a leading expert, defines it as "A pattern of shared basic assumptions that the

group learned as it solved its problems of external adaptation and internal integration that has worked well enough to be considered valid and therefore should be taught to new members as the correct way to perceive, think and feel in relation to those problems."[14] The Army defines organizational culture as "shared attitudes and values, goals, and practices that characterize the larger institution. It's deeply rooted in long held beliefs, customs, and practices."[15] These deeply held beliefs have served the institution well or they would not have been retained. But since the current strategic environment presents a greatly different set of circumstances, the problems referred to by Schein have changed. They have been irrevocably altered by two fundamental facts: First, the impact of the information revolution; second the asymmetric threat posed by non-state actors who have no physical land base to target and who seem to be highly adaptive to traditional tactics.

Within large organizations or groups of people with specific functional aptitudes, there are often subcultures. These subcultures can make it very difficult to identify broad over-arching values and beliefs, because they are shaped by the subculture environment and differ throughout the culture because of competition between the subcultures. Subcultures develop from varying mission requirements and resulting policies that define "the way we do things around here."[16] Accordingly, one would expect culture in the Air Force to be different from the culture in the Army. Indeed, we can identify sub-cultures all the way down the chain from one office to another or from one unit to another. Knowing this, let's analyze the two critical cultures that will affect the success of transformation, the military and the technologists.

Military Culture

Despite variations among sub-cultures, we can find shared values throughout our larger military culture: strong sense of community, strong commitment to core values, highly effective training, and commitment to the goal of fighting and winning our nation's wars. These characteristics are positive and honorable. However, they can trigger second- and third- order effects which portend possible conflicts as military personnel are forced to relate to and communicate with other civilian professional cultures. Because of these honorable values military personnel can sometimes see civilians as less committed, because they have other motivations such as financial gain. Additionally, the move to an all-volunteer force has re-enforced these core traits causing military personnel to not recognize their alienation from American society. As a result of multiple generations growing up and serving in the military community, the gap between the culture value of the broader US society and US military personnel is widening, especially in the officer corps. Military personnel are trained specifically

in decision-making and leadership, which often involves developing high levels of confidence in their skills and abilities to perceive the world effectively and make good decisions. Much of this is re-enforced when, in an effort to increase the skill sets of junior officers, they are placed in highly responsible positions as a part of their professional progression, which provides a base of experience to solidify their abilities. Unfortunately, this can result in an unhealthy confidence, which causes them to believe that civilian personnel cannot possibly offer valuable input for warfighting decisions. Army FM 1 the "Can-Do" characteristics of the Army mentality: "I will always place mission first. I will never accept defeat. I will never quit. I will never leave a fallen comrade.[17]" But this "Can-Do" attitude is often misinterpreted by civilians. This proactive attitude contributes initially to successful wartime efforts. But unfortunately, if this attitude carries into the requirements, planning, and budgeting process, civilian leaders often misinterpret it. They may interpret in such a way as to reduce funding for technology and systems that can be improved by technology, because the warfighters portray a confidence that they can do the job no matter what, no matter how inadequate the equipment or resources. It is the US military's job to fight and win the nations wars to the best of their ability within whatever constraints civilian leadership determines.

Each service subculture is reinforced by its traditions and focus on mission. Since the Air Force relies on the platform - the airplane - much attention is focused on the benefits that technology offers. The Air Force leverages increases in capabilities to greatly enhance mission effectiveness. Even though human expertise remains critical to their mission, the fact is that without the airplane they cannot fulfill their mission. As a result, the Air Force must be considered a platform-centric force in which people are not the main fighting element.

Similarly, the Navy's main fighting element is the boat or ship. Again, people provide the operational expertise to effectively use the platform. But in fact the platform is the focus of the Navy's warfighting capabilities.

Conversely, the Army's main platform is the soldier. No matter what technologies support the soldier, he is the main fighting platform as described in FM 1.[18] This significantly alters the way the Army sees the world. Army officers and enlisted personnel regard technology as an asset supporting the human endeavor. Army personnel believe, and rightly so, that it is the human mind the makes the ultimate difference on the battlefield. In general, any concept that Army personnel perceive as trying to replace what they consider an inherently human function is immediately rejected. Robots will likely be a good example of this as they become more advanced and begin to increase their role on the battlefield.

During the industrial age the Army developed a culture and identity which accepted technology as worthwhile to provide better capabilities for their functions, such as improved maneuvering with the tank and more accurate guns for better shooting. But the Army has not truly embraced transformational information technology. In general, if you ask an Army officer about technology while an Air Force officer is present, the Army officer will defer to the Air Force officer. Air Force personnel are regarded as experts in technology; more importantly the Air Force is known as the technology arm of our military capability. Thus new methodology such as effects- based planning seems designed solely to promote the use of air power verses land power to accomplish our nation's military missions. So the Army and Marine Corps fear that their core competencies of land power will be undervalued in the budgeting process, and they will lose their funding. With components of military culture in hand, we now turn our attention to understanding technical culture.

Technical Culture

> It is a great profession. There is the fascination of watching a figment of the imagination emerge through the aid of science to a plan on paper. Then it moves to realization in stone or metal or energy. Then it brings jobs home to men. Then it elevates the standards of living and adds comforts to life. This is the engineer's high privilege.[19]

Very little research explores the culture within the technology community or its sub-cultures. Generally, technologists are known as introverted, highly intelligent, and lacking interpersonal skills, especially communication. They may thus be perceived as arrogant or condescending. Paul M. Leonardi wrote a master's thesis in 2001 that discusses the communication skills of engineers. He asserts that engineers have a defined culture that they believe in.[20] Moreover, he posits that engineers identify more with their occupation than with their company; he describes their culture as "pervasive and persistent". They are taught how to think as engineers, and this world view is re-enforced throughout their careers by co-workers and professional organizations.[21] Most importantly, "Scholars, practitioners and employers alike are noticing that engineers are not well equipped to work with other individuals to bring a project to fruition, even though the scope of most projects is such that they require multiple engineers to work simultaneously with them."[22] Of course, we may conclude that if engineers can't even work effectively among themselves, it is unlikely they can work effectively with other professionals. Further, "rewards for engineers are often based on individual rather than teamwork and achievements on specific projects are hailed above sustained performance."[23] This further exacerbates and solidifies their individualistic tendencies. For the remainder of this

discussion both scientist and engineers will be referred to as technologists. No discussion of technology and its culture, especially in reference to our military, would be complete without considering the Defense Advanced Research Projects Agency (DARPA) as an extreme case based on its mission and accomplishments.

DARPA is the country's premier research organization; it is managed at the highest levels of the Department of Defense. Organizationally flat, it employs the best and brightest technologists our nation has to offer. They are highly creative and generously funded to research the accuracy and feasibility of their ideas. "DARPA's mission is to maintain the technological superiority of the US military and prevent technological surprise from harming our national security by sponsoring revolutionary, high-payoff research that bridges the gap between fundamental discoveries and their military use."[24] DARPA was established in 1958 to prevent another technological surprise such as Sputnik, which dramatically demonstrated that the Soviets had beaten the US into space.[25] The DARPA mission has evolved from preventing technical surprise to include creating technical surprise.[26] "Radical innovation for national security"[27] is a DARPA imperative.

Because of its mission and its organization, DARPA has its own unique technologist culture. It is predominately filled with short-term (three-year assignments) technologist PhD's across all technical domains. DARPA's focus is on advanced technology so it invests large amounts of funding to high-risk and high-payoff ideas. All services have an incredible opportunity to use this technology incubator to solve their most difficult challenges. The Air Force does this exceptionally well. On the other hand, the Army is actually, at times, resistant to facilitating new ideas through the DARPA process and accepting DARPA technology. The Army's resistance is likely due to the cultural boundaries analyzed previously. Indeed, the Army exhibits an almost intractable aversion to technology solutions. This is likely rooted in the historical fact that the last time the Army found a new truly revolutionary technology, it was the airplane. As we all know, the Army lost this capability with the establishment of a new and separate service called the "Air Force."

This history, along with the Army's institutional reliance on their main platform of the "soldier" makes the Army's acceptance of technologies such as Information Technology (IT) particularly difficult. The great advantage IT provides in transformation is its ability to sort through large amounts of data and integrate it into information, which can then be transformed into knowledge by commanders and staffs. Unfortunately, this process is sometimes confused with Artificial Intelligence technology and mis-perceived as replacing the critical human function of thinking about and solving complex problems. A more accurate view is that IT can off-load

many spatial and temporal data integration tasks to computers, thereby giving commanders and staffs more time to assess the situation and think about the enemy's intent.

A critical issue that confounds the DARPA/Army relationship is the nature of DARPA leadership and its employees. The problem is political and personal, reflective of the personalities of the technologists recruited to DARPA. DARPA technologists are known for their arrogance, and their ruthless desire to get results. This is not true in every case, but these individuals would not be selected into DARPA if they did not believe in the superiority of their ideas. They are under great pressure to show results in two to three years. So DARPA provides a highly competitive and individualistic environment. In fact, DARPA officemates often do not see each other for months at a time. Collaboration is not rewarded or encouraged inside DARPA. However, they are forced to form relationships with their target services to facilitate technology transition. Warfighters are also results driven, but they have learned to work in collaborative teams, where as DARPA technologists believe they do not need collaborative relationships. They believe they have what the military needs, but military officers just don't know they need it. Of course, this is not always the case. Both DARPA and the military leadership strive to overcome these cultural barriers, but systemic cultural issues cannot always be broadly addressed.

Divisive Cultural Traits

Cultural traits found in large cohesive groups can lead to effective working relationships or to competitive and adversarial interactions. Some of the traits that cause conflict are: differing views on problem solving, lifestyle issues, rectitude, rigidity of worldview, team views and values. Traits or conditions that can cause synergy and provide common ground for cooperation are: capability to perform highly complex tasks, competitiveness, creativity, and respect. A deeper look into each of these provides a better understanding of their impact on each culture.

- Different views about problem solving: Warfighers see the world from a perspective of combat. They respect the ability to fight and win battles and wars through destruction and control by highly trained "people". Technologists see the world as an endless set of challenges requiring better or new machines to solve them.
- Lifestyle: Warfighters are accustomed to tightly integrated communities, living together in small safe locations, controlled career movement, little control over centralized decisions on where they will be living, and adherence to deeply internalized values of loyalty, honor, and duty. Technologists live highly non-

integrated lives, relying of freedom of ideas and movement. They depend on themselves for advancement; and they transcend boundaries in pursuit of their interests.

- Rectitude: Technologists, especially engineers, like to be right and will deny other views if they conflict with their perceived correctness. For engineers to be found wrong is a direct blow to their self-esteem and worth. They cannot separate themselves from their profession. To be wrong for an engineer is to be of no value in general. "… engineers revel in their expertise about technical matters and will not concede to other points of view."[28] Warfighters have similar morays that relate to their core competencies. They will reject new ideas if they threaten to change the status quo that they were trained on. Military training effectively orients warfighters to believe the way they were trained is the right way and alternate approaches are suspect.
- Rigidity of world view: Because of their culture, soldiers live and work together for years always in a similar environment, so they begin to share very strong opinions which are rarely divergent. Groupthink becomes more prevalent and goes unchallenged as they discover what it takes to be accepted and get promoted. Technologists manifest a rigid worldview by virtue of their belief that their analysis must be right, so they may believe it is impossible for their view to be incorrect even in light of new data. They believe they are the best trained. They believe that, as a group they think more effectively than others. They believe they are better suited morally to assess and solve problems in their professions.
- View of teams: Military personnel are trained to accept and perform well in teams, especially the Army and Marine Corps who rely on the human component to become highly effective. Technologists are exactly the opposite. They rely on independent behavior throughout school and in most professional assignments. Technologists who show aptitude for working in teams are sometimes actually chided as not being technical in spite of their education and accomplishments.

Cultural Traits That Contribute to Synergy

- Ability to perform highly complex tasks: Both the military and the technological professional are trained to perform highly complex tasks. However, the types of tasks differ. Military forces are engaged in the synchronized coordination of weapons systems and people to engage opposing forces; ineffective performance result in the loss of life and potentially the US way of life. Conversely, technologists have little or no reliance on

other people for success. They thrive on individual success for self-worth and pride. They need successes to enhance their self-image. They work on highly complex technical problems; solutions come in the form of ideas, equations, and concepts or designs.

- Highly competitive: By their very nature as a soldier, the core competency is to fight and win. This is trained at every level. The very essence of the military is to fight and win our nation's wars. Technologists are highly competitive and derive their self-esteem and self-worth from winning self-imposed competitions. They place high value on technical achievements, on their recognition and awards. These achievements prove to them they are better than their peers. They desire to be better than their peers and want to out-do their mentors and teachers. Such competitiveness is inculcated during college and reinforced during their careers.
- Creativity: Both groups are highly creative and utilize this skill effectively to solve problems. If this creativity is harnessed in an integrated environment where everyone is seeking common goals, it can be very powerful.
- Respect: Respect often comes from recognition that another cultural group effectively accomplishes tasks that the other group would not want to carry out. Technologists do not typically want to destroy, so they are pleased someone else will provide the necessary military force when needed to protect them. Complementarily, warfighters are so focused on winning the nation's wars that they do not wish to engage in theorizing about future technological possibilities until they can be proven to be of tangible benefit. When this occurs and they can receive a weapon that shoots farther or a sensor that provides better intelligence, they are pleased someone else provided the performance gain.

The critical juncture for effective transformation is revealed at the intersection of these two well-defined cultures. Warfighters don't always know they need a capability until they see it working in an environment that shows marked improvement over current capability. In essence, they need to see it and feel it to be able to visualize its value. Conversely, technologists often do not know how to create this type of environment because they do not understand the culture of the warfighter or how to translate their own ideas into mental models that warfighters can quickly recognize.[29] As a result, great new technologies can often left un-utilized even though they may cost less and be more effective. Even worse, marginal technologies, possibly very expensive and less effective, are invested in and procured. Effective cultural integration can resolve these issues. Finding a new way to accomplish this integration is the true challenge in

creating a more effective and transformational military instrument of national power. But solutions do exist and can be implemented to facilitate transformation.

Possible Solutions

Military personnel and technologists will work together cohesively only when they are physically placed together to achieve very focused tasks. Then they become dependent on each other for success, which becomes their shared goal. Their collaborative efforts overcome all other barriers and eventually produce measurable results as their working relationship improves and biases disappear. The skills developed by both groups placed in these circumstances will remain as a part of their professional lexicon throughout their careers and provide opportunities for clear vision as they becomes strategic leaders.

Further, integration between warfighters and technologists must start on common ground to build trust, understanding and respect. This will facilitate effective cooperation and the achievement of institutional transformation. Effective leadership and the concept of "great groups" can enable this integration.[30] In order to get these groups to integrate, an institutional effort must strongly support this. Interpersonal issues must not be ignored. They can be addressed by establishing service labs that train each group to work with the other in an integrated way. Both the DOD technology community and the military culture must require participation in one of these venues throughout career development to re-enforce for both communities the need for synergy in the development of DOTLMFP capabilities.

President George W. Bush declared that "Our military must reward new thinking, innovation and experimentation"[31] Focused integrated experimentation both at the joint level and the service level provides a venue for learning how to utilize new thinking and innovation in our military structure. The experimental environment must foster a climate where individuals are vested in success and are encouraged to test new concepts, find solutions, and fail constructively. Much of our best learning comes from failure, which causes us to critically think about what went wrong and correct these mistakes in the future. As BG Fastabend, now MG Fastabend, observed about a culture of innovation and experimentation, "Experimentation and prudent risk-taking are admired and encouraged. Experimentation is not a destination to be reached, but an unending process or trail, feedback, learning, renewal and experimentation again."[32] To effectively experiment in an environment designed for investigation, our change agents must address issues across doctrine, training, material, organization, and leadership. This can be done by using the model of Great Groups. *Organizing Genius: The Secrets of Creative Collaboration* offers examples of Great Groups: "The process itself was exciting, even

joyous…Something happens in these groups that doesn't happen in ordinary ones, even very good ones. Some alchemy takes place that results not only in a computer revolution or a new art form, but a qualitative change in the participants. If only for the duration of the project, people in Great Groups seem to become better than themselves. They are able to see more, achieve more and have a far better time doing it than they can working alone."[33] Moreover, technologists will enjoy the newfound experience of successful teamwork. An example of such a group is the recent DARPA/Army FCS C2/M&D C2 (DAFM) experimental program, which began in FY 2001 and ran through FY 2006. It offers an insightful case study in the principles of Great Groups.

The DARPA/Army cooperative experimentation venture initially focused on providing an integrated battle command system for the Army's future force. Its goal was to compress time for commanders, allow commanders to get inside the enemy's Observe, Orient, Decide and Act (OODA) loop and thus provide the decisive edge through supporting the art of command with application of new architectures and information technology. It accomplished all this and more. But more importantly, it provided a model for how effective experimentation can lead to unforeseen innovations.[34] It provided a venue for multiple and disparate cultures to collaborate and find effective solutions relatively inexpensively. It also provided a compelling case study of how a great concept can be lost if leaders are unable to grasp innovative ideas because they don't conform to the simplistic mental models of large institutional cultures.

How did it work? DAFM brought together warfighters (retired and active duty/Blueforce and Opposing Force [OPFOR]), Contractors, and Army civilians with backgrounds as Operations Research and Systems Researchers (ORSAs), scientists, engineers, software developers, academics, TRADOC personnel, trainers - all with institutional biases, great intellectual capabilities and most importantly a desire to innovate. This hand-picked, well-resourced team, enjoyed the protection of DARPA from outside Army bureaucratic influence. The team shared an isolated work environment or laboratory in which it conducted rapid spiral experiments under high-pressure conditions.[35] The active duty personnel and most retired warfighters joined the group periodically to provide critical critique, and competing visions of the design. The engineers, designers, and software developers watched full-time along with the DARPA Program Manager (PM), off-site, and the Army Deputy PM on-site.

The team was mentored through a twelve-month architecture development process specifically designed to break existing paradigms and force creative thinking about battle command in a "Network Centric"[36] /information technology (IT) leveraging mental model.[37] This team produced an integrated battle command system with real-time decision support

applications across multiple Battlefield Operating Systems (BOS) or Battlefield Functional Areas (BFA). This battle command system was submerged into an entity based constructive simulation environment that created the virtual world supported by high fidelity sensor models and virtual interfaces for infantry, drivers, and gunners. The commanders and staffs were placed in battle command modeled vehicles to create Unit Conduct of Fires Trainer (UCOFT) except for battle command. These units fought against the Deputy Chief of Staff for Intelligence's (DSCINT) world-class opposing force (OPFOR), managed in Ft Leavenworth KS (Red). The scenarios were TRADOC approved and no scripting was allowed. Free play was critical to the learning model. Each side won or lost battles based on their own abilities. This freedom and the level playing field were important components of the environment. Both the Red Team and Blue Team trusted the technical team not to provide advantages in order to prove a particular technology or tactic was superior. Red and Blue won almost equally in each experiment, but the technical team learned more when Blue lost: In fact, the Blue team had better (futuristic/integrated) tools, but was highly out-skilled by the combined experience of the world class OPFOR (red). This result is profound because it demonstrates that there is no substitute for a well trained and experienced brian. Technology still is not at a point where it can replace the human tough process when free from stress.

Organizing genius refers to two other components of great teams. "Great Groups and great leaders create each other."[38] Further, "Every Great Group has a strong leader."[39] The DAFM program uniquely had two strong leaders. The PM at DARPA was a military officer, who retired during his tenure at DARPA. He provided critical skills in understanding the Army's battle command problems and a deep understanding of how to innovate ideas at the director level of DARPA, a skill developed while on the DARPA Director's staff. This PM brought with him contacts and planning experience unequalled in typical program managers. He also did not typify the traditional DARPA PM character. He was ordered and methodical, but a highly reasonable and personable individual who saw the chance to run a program like this as an honorable duty, which fostered his enthusiasm and successes with the group. The DPM, on the other hand, was a not a typical technologist. She brought a wide range of systems engineering experience and pulled together a great set of technologists anchored in a seldom used practice of allowing government technologists to perform the integration roles. This method was approved by the DARPA PM who believed it produced better program control. These two leaders collaborated in ways rarely found in typical military/civilian relationships. Management was focused, clear and always in sync. Both these leaders typified the Great Group principle of seeking talent and knowing where to find it.[40]

Great Groups are full of talented people who can work together. This does not mean the team agrees all the time or even most of the time; what it does mean is that the team has a methodology to resolve conflicts and has an open and accepting understanding of risk. At times this group, motivated by its leaders, accepted the risk of slipping the schedule or found work-around methods to reduce the risk while holding schedule. These decisions did not always work, but in the end the actual experiments were executed and results were achieved. The flaws in the system were honestly detailed in the report. But what is significant is that the group kept moving forward with new ideas and implementation of those ideas. "Great Groups think they are on a mission from GOD."[41] The PM and DPM had already accepted this calling based on their personalities. But the entire group was quickly integrated into this mental model when 9/11 attackers hit the World Trade Center twin towers only forty miles north of their work site. This event, the following operational engagements, and visits from the Army Secretary, Army Chief of Staff and various other high level Army and DOD leaders elevated the team's efforts to amazing levels. The metaphor referred to in *Organizing Genius* of the group being an island held true for this group.[42] The PM and DPM handled all interference from higher headquarters in both DARPA and the Army, thereby protecting the developmental and experimental team from outside influence and bureaucracy. "Great groups see themselves as winning underdogs."[43] The DAFM team had a common enemy that served as a Goliath with all the power and influence. Yet the team's successes could not be denied; they had triumphed over less imaginative local leaders. This also satisfies the requirement that "Great Groups always have an enemy."[44] They had two: Al Qaeda and local leadership that had a perceived vested interest in their currently fielded system, the Army Battle Command System (ABCS). The local leadership saw the team's work as threatening their primacy and influencing the Base Realignment and Closure (BRAC) process, in spite of great efforts to create partnerships and cooperation by both the PM and DPM. In fact, a failure of leadership by all parties prevented the DAFM work from being leveraged by the ABCS systems.

The DAFM team, for the most part, met the rest of the following requirements: "People in great groups have blinders on…Great Groups are optimistic, not realistic… In great Groups the right person has the right job…The leaders of Great Groups give them what they need and free them from the rest…Great Groups ship…Great work is its own reward."[45] In fact, this was truly a Great Group as described in Organizing Genius.

The team was not without its share of conflict. In fact, conflict provided some of the best advances. The key was to manage conflict to provide positive outcomes. In this case, it was critical to listen to the other view, think about it and offer solutions. This process can be rapid, at

other times it can be slow. But during the process, it is critical for the leader to keep all parties wanting to participate in order to sustain a stimulating and productive environment. This, of course, implies that the hardware and software must work without catastrophic failures, the experimental environment must be well controlled and the entire team must respect the leader or leaders. In this case, there were two leaders. But these two leaders were integrally linked and spoke with one voice.

The environment worked. Technical issues were resolved on site and in real time, building the confidence of the operators, analysts, and the senior mentors. The PM held periodic program reviews during which senior Army leaders would review the program and provide feedback to the PM and DPM, identifying the gaps and flaws in the experimental program. This outside view proved most helpful for the analytic side of the program. A detailed analytic methodology evolved over time, providing the richest and most insightful analytic environment ever built for understanding and measuring the effectiveness of the battle command system. The then - Army Secretary Thomas E. White said of this environment, "It is the key to the universe"[46] Ultimately, this team formed its own culture, believing they had the critical solutions to enable the future force to be a more effective fighting force.

So, why didn't this ingenious program transition effectively to the Army? Surely there were attempts made to transition products from the program across the DOTMLPF, but this was left unaccomplished. There are many reasons, but only two are pertinent for this analysis. First, the Army had not witnessed or participated in an experimental venue such as this so it was unprepared to understand its value or fund it. It could not decide where, across the broadly separated crevices in the DOTLMPF, it made sense to place this new capability. Second, once proper placement of the program was decided, the Army, now at war, and dealing with mounting training and operational issues clearly had higher and more pressing priorities. However, from a different cultural perspective, the real issue was that the true value of the experimentation was not appreciated in the culture of the Army or in DOD. This is where an institutional change must be made to create a culture of integrated warfighter/technology learning and innovation.

Yet, we must acknowledge that the experimental process and environment has already been created – on a small scale - in the DFAM program. The concept works exceptionally well. The DAFM program was focused on battle command. But in order to perform that function well, all other capabilities and functions had to be effectively represented in the virtual world constructed by the simulation environment. DFAM spent much of its funding on improving the constructive and virtual M&S environments to assure they were adequate for the necessary experimentation. A holistic M&S environment still does not exist even though there is no

specific technical barrier to constructing a realistic virtual environment of our world appropriate for broad ranges of experimentation. It is simply a matter of funding. Consider this example of how this has been de-emphasized in the Army: the most critical entity based simulation One Semi-Automated Force (OneSAF), has been funded at only approximately $20M per year. OneSAF is primarily responsible for providing a constructive training environment and secondarily to support high fidelity experimentation. This level of funding is simply unacceptable for an Army accelerating transformation across the DOTMLPF. To effectively transform, the Army must be able to test ideas and concepts in a high-tech experimental environment with well-developed simulations that can be modified to support the experimental objectives. This would allow programs like DFAM to invest all of their resources in discovering the new ideas and methods that the military needs to understand more deeply verses improving the infrastructure required to support that testing.

Conclusion

This Strategy Research Project (SRP) analyzes a critical problem facing our military, specifically the Army and Marine Corps. It provides a solution that has already been prototyped and has provided great results.[47] It offers, a roadmap for how to accomplish integration of two of our nation's greatest resources, military warfighters and technologists. Our world is changing quickly not simply because of the asymmetric threats we now face, but also because the pervasive use of technology, both hardware and information management. As humans, we continue to struggle to appreciate the impact of technology on our lives. As a military, we must find a way to recognize its implications and harness its value to win our nations wars. We need to understand how to best integrate it with our human skills and abilities so we are enhanced by it. We need to do this quickly and holistically, before our enemies can exploit it. We must seize the initiative and keep it. This means we must become intellectually quick and innovate in real time. These experimental venues can help sort out ideas analytically, without having to rely on actual physical weapons systems, which are expensive to operate and hard to instrument for data collection over multiple dimensions of the DOTLMPF. However, in order to do this well we must accept failure - try and fail and try again. Such efforts will reward us in the near- and long-term. If we get it right, the long-term payoff will enable us to deter our enemies and attempt to ensure that peace is the norm throughout the world.

This approach relies on leadership: "Without leadership to verify or challenge subordinates' recommendations, problem–solving often focuses on the short term, thus deferring creative, forward-looking solutions to the next-hopefully more technically

knowledgeable-commander."[48] In addition to fostering strong critical-thinking leadership, experimentation can facilitate the process of growing these critical skill sets in younger warfighters without the catastrophic effects that can occur on the battlefield. In other words, experimentation offers not only the answer to critical questions facing our military during transformation, but also creates an environment to train military participants in how to think about emerging problems and to see a bigger picture. The DFAM program illustrated this during every experiment. The warfighter participants always left the environment understanding more about tactics, battle command, and its future than prior to the experiment. Although the quote above was written about Air Force efforts in space, it is highly applicable to all the services. Experimentation also relies on leadership understanding the benefits of cultural diversity and cultural integration. "When appropriate, strategic leaders must understand and re-enforce that value congruency between organizations and appreciate the potentially different perspective that both military and non-military organizations bring."[49] Experimentation brings this perspective together into a high payoff environment; it provides the US with a decisive edge from rapid innovation of ideas and concepts before bending metal. Ideas and concepts can be investigated in highly complex environments, facilitating learning and adaptation. These concepts are not limited to strategic leaders. In fact, this is precisely the ability needed in all levels of military leadership. In order to pursue this approach, we must train our DOD technologists like our military personnel to believe that: "Life in Great Groups is different from much of real life. It's better."[50] "Ultimately, our ability to rapidly adapt our doctrine, organization, training, leadership and education, personnel and facilities will be the measure of our institutional agility –and clear proof of a culture of innovation."[51]

The time has come to join together and overcome cultural barriers. We must mass our energies and strengths against the will of our enemies. The diversity that forms the core of our American heritage is our deepest strength for generating ideas and fostering creativity. Our military must become a constantly changing institution capable of leveraging the information explosion and all other technical emerging innovations, using them to our advantage. Three things must occur to establish and maintain flexibility and adaptability on the ever changing landscape of today's and tomorrows battlefields. First, the military (especially land forces) and the technical professions must overcome their current barriers, leading to the effective generation and integration of ideas, concepts, and ultimately solutions.

Second, the way to break the current cultural barriers is to acknowledge them and begin to train the civilian technical workforce to become more effective team members. We can accomplish this by creating training programs and establishing long standing experimentation

facilities based on Great Group principles, where both technical civilians and military professionals are forced to work together to achieve measurable results. Finally, each group participating in experimentation must believe in the process. It must benefit them personally and professionally and must show ways to improve our nation's defenses.

Similar barriers have been overcome in the past, such as the shift from service components fighting wars independently to joint operations in which all the services work synergistically together towards a common goal. This paradigm shift required each service to be dependent on each other, thereby developing an appreciation for the value of each service. Technology's impact on our world, our enemies and our military will not abate, in fact it will increase. We must build the experimental capacity and leverage its potential to continue to fight and win our nation's wars.

Endnotes

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[35] Bennis,197. The team was hand picked by the PM (Military professional, off-site manager) and DPM (technologist, on-site manager) hand picked team were the best and brightest.

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